CLAIMS

1. A contrast improving sheet to be used in combination with a display, said contrast improving sheet comprising an optical element adapted to emit image light rays substantially perpendicularly incident on an entrance surface thereof in a direction substantially perpendicular to an exit surface thereof regardless of incidence position on the entrance surface and to absorb stray light rays obliquely incident on the entrance surface and external light fallen on the exit surface.

2. The contrast improving sheet according to claim 1, characterized in that the optical element comprises:

a first optical functional element provided with a plurality of protrusions arranged in a direction or distributed in a plane, each of the protrusions having a pair of opposite total-reflection facets for totally reflecting image light rays substantially perpendicularly incident on an entrance surface thereof and a flat facet extending between front edges, on a side of an exit surface thereof, of the pair of opposite total-reflection facets, and light absorbing layers formed between the adjacent protrusions; and

a second optical functional element attached to a surface, on a viewing side, of the first optical functional element, and provided with a light path correcting layer for correcting light paths followed by the image light rays totally reflected by the total-reflection facets of the protrusions such that the image light rays are emitted through an exit surface thereof substantially perpendicularly to the exit surface.

3. The contrast improving sheet according to claim 2, wherein the light path correcting layer of the second optical functional element has a plurality of inclined surfaces formed in an alternate arrangement and adapted to emit the image light rays totally reflected by the total-reflection facets of the first optical functional element in a direction substantially perpendicular to the exit surface.

4. The contrast improving sheet according to claim 3, characterized in that the inclined surfaces included in the light

path correcting layer of the second optical functional element are formed such that substantially parallel are both image light rays substantially perpendicularly incident on an entrance surface thereof, traveled through the flat facets without being reflected by the total-reflection facets of the protrusions of the first optical functional element, reflected by the inclined surfaces and refracted at the inclined surfaces, and image light rays totally reflected by the total-reflection facets of the protrusions of the first optical functional element, traveled through the flat facets and refracted at the inclined surfaces.

5. The contrast improving sheet according to any one of claims 2 to 4, characterized in that the light absorbing layers of the first optical functional element are formed of a transparent material having a refractive index smaller than that of a material forming the protrusions of the first optical functional element, the light absorbing layers containing light absorbing particles.

6. The contrast improving sheet according to any one of claims 2 to 4, characterized in that the light absorbing layers of the first optical functional element are formed of a colored material having a refractive index smaller than that of the material forming the protrusions of the first optical functional element.

7. The contrast improving sheet according to any one of claims 2 to 6, characterized in meeting a condition expressed by an expression: $n_3/n_2 = \cos 3\theta_2/\cos \theta_2$, where θ_2 is an inclination angle of the inclined surfaces of the light path correcting layer of the second optical functional element (angle between each of the inclined surfaces and a normal to a sheet surface of the second optical functional element), n_2 is a refractive index of a material forming a part of the light path correcting layer on a side of the first optical functional element with respect to the inclined surfaces, and n_3 is a refractive index of a material forming a part of the light path correcting layer on the opposite side of the first optical functional element with respect to the inclined surfaces.

8. The contrast improving sheet according to any one of claims 2 to 7, characterized in meeting a condition expressed by an expression: $n_2 \cdot \sin 2\theta_2 = n_1 \cdot \sin 2\theta_1$, where θ_1 is an inclination angle of the total-reflection facets of the protrusions of the first optical functional element (angle between each of the total-reflection facets and a normal to a sheet surface of the first optical functional element), n_1 is the refractive index of a material forming the protrusions of the first optical functional element, θ_2 is an inclination angle of the inclined surfaces of the light path correcting layer of the second optical functional element (angle between each of the inclined surfaces and a normal to a sheet surface of the second optical functional element), and n_2 is a refractive index of a material forming a part of the light path correcting layer on the side of the first optical functional element with respect to the inclined surfaces.

9. A rear projection screen for displaying images by transmitting image light rays projected thereon and emitting the image light rays toward a viewing side, said rear projection screen comprising:

a Fresnel lens sheet that deflects image light rays incident on an entrance surface thereof toward a viewing side in a direction substantially perpendicular to an exit surface thereof; and

a contrast improving sheet as set forth in any one of claims 1 to 8, the contrast improving sheet being disposed on the viewing side of the Fresnel lens sheet.

10. A rear projection screen for displaying images by transmitting image light rays projected thereon and emitting the image light rays toward a viewing side, said rear projection screen comprising:

a Fresnel lens sheet that deflects image light rays incident on an entrance surface thereof toward a viewing side in a direction substantially perpendicular to an exit surface thereof;

a lenticular lens sheet disposed on the viewing side of the Fresnel lens sheet to diffuse the image light rays; and

a contrast improving sheet as set forth in any one of claims 1 to 8, the contrast improving sheet being disposed on a viewing side of the lenticular lens sheet.

11. The rear projection screen according to claim 10, characterized in that the lenticular lens sheet has a front surface, on a viewing side, coated with a light absorbing layer, and the contrast improving sheet is bonded adhesively at least to the light absorbing layer of the lenticular lens sheet.

12. A rear projection screen for displaying images by transmitting image light rays projected thereon and emitting the image light rays toward a viewing side, said rear-projection screen comprising:

a Fresnel lens sheet that deflects image light rays obliquely incident on an entrance surface thereof toward a viewing side in a direction substantially perpendicular to an exit surface thereof, the Fresnel lens sheet including a total-reflection Fresnel lens formed on an entrance surface thereof, and a contrast improving sheet as set forth in any one of claims 1 to 8, the contrast improving sheet being disposed on an exit surface thereof; and

a lenticular lens sheet disposed on the viewing side of the Fresnel lens sheet to diffuse the image light rays.